Nevada Operations Office
Unaddressed Needs

Down Hole Real-Time Monitoring of Radiation (Mainly Tritium) in Boreholes (NV13-9801-01)

The need is for a durable, reliable, and accurate system that will monitor relatively low levels of radiation in deep monitoring wells. Tritium is the main focus, but other radionuclides associated with underground testing are of interest. The detection limit for tritium should be approximately 1000 pCi/1 or as low as reasonably achievable. The wells may be in excess of 1000 meters deep and the probes could be under several hundred meters of water. The probes also need the ability to be rapidly removed so water samples can be collected. The non-RAD parameters should be measured in a manner consistent with the best available field techniques. Well casings will range from 2.75 to 6 inches in diameter; however, access tubing in most wells will have internal dimensions of 1 11/16 inches. A device designed to 1 11/16 inches will have wide applicability. There may be a need to consider monitoring different depths simultaneously. Also, parameters such as water level, temperature, pH, and conductivity, would be of interest.

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***Deep Well Sampling (NV11-9801-02*)**

A cost-effective well design and sampling technology for sampling groundwater for radionuclides and other physical and chemical parameters in deep (up to 1,000 meters) wells in remote areas is needed. Sampling should be unaffected by well design or well materials. The requirements include: (1) the ability to collect approximately four liters of water from depths of up to 1000 meters; (2) minimize the volumes of fluid removed from the well; (3) ability to demonstrate that the sample is representative of the information; and (4) the equipment must be easy to be decontaminated between samples.

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Volume Reduction (NV01-9801-04)

A process is needed that will efficiently separate “clean” soil from (Bioremediation) contaminated soil. It is desirable to be able to concentrate approximately 80% of plutonium, in 20% of the volume (mass). Most effective in remote location is where hauling of soils and/or water cost are prohibitive.

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Improved Groundwater Transport Models (NV12-9801-03)

Current groundwater transport models do not adequately account for subsurface physical and chemical variability, and may predict different concentrations or travel times than observed. The impact and complexity of fractured media are not adequately represented in the models. The need is to improve radionuclide transport models that incorporate geologic heterogeneity and other real-world factors. The models must be efficient to run on PC-type computers and not require extensive data. The computations must be able to be understood by technical individuals but not necessarily individuals that utilize models regularly. The model needs to be able to handle complex hydrogeologic environments and provide output that contains uncertainty terms.

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Precision Soil Excavation (NV02-9801-05)

Past nuclear weapons safety experiments have resulted in large areas of near-surface soil contaminated with plutonium. The profile distribution of plutonium is predominantly limited to 3-4 inches in depth. There is a need to remove indigenous vegetation and uniformly excavate one inch of contaminated soil efficiently without over excavation or “leaving behind” significant levels of plutonium. Efficiently remove “all” plutonium from ½ to 1 acre per day while maintaining or decreasing dust generation compared to conventional excavation. The process must account for uneven soil surface, vegetation removal, and large acreage of surface.

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Operational Process Analysis for TRU Waste (NV16-9801-07)

An integrated systems analysis approach is required that involves various analytical and materials processing that leads to a waste that is acceptable to the Waste Isolation Pilot Plant (WIPP). The technology must result in compliance with the WIPP Waste Acceptance Criteria and must be coordinated with the other DOE sites. Currently, certification of Mixed TRU waste involves package radiography, visual inspection, analytical sampling, headspace gas sampling, radio assay, and packaging. The problem is complicated by irregular shape and oversize packaging with complicated geometries. The non-standard size packages need additional size reduction for acceptance. There lacks an integrated system that will account for certification of all existing TRU and Mixed TRU waste forms. This allows the Mixed TRU waste to be subjected to adverse and potentially costly regulatory actions. The magnitude of the problem includes 1,650 drums of Mixed TRU, 300 drums of classified TRU and Mixed TRU, and 58 non-standard size boxes of classification unknown waste. The system or systems must be capable of handling all types of TRU and Mixed TRU waste forms. It must also provide for waste form stabilization. The non-standard packages need additional size reduction for acceptance. The final product is a package of size and shape suitable for shipment to the WIPP with the necessary documentation required. It is desirable that the process be privatized and mobile so that the system may be used at other DOE sites.

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Long-Term Monitoring of Upward and Downward Pathways in the Vadose Zone and Closure Caps (NV08-9801-08)

Design a system, including instrument packages and their deployment geometry, for long-term monitoring of the downward and upward pathways associated with low-level waste disposal sites to meet regulatory requirements, and test and refine conceptual models used in performance assessments. This system must be able to monitor the movement of water into and out of the waste zone, the rate of gas emissions with emphasis on tritium and radon releases at the surface and beneath the closure cap and above the waste, and plant-root penetration and contaminant uptake. The system will likely require the integration of point measurements, such as time domain reflectometer, psychrometry, and non-intrusive measures, such as ground-penetrating radar, with simplified yet robust process level models of the upward and downward pathways. Other possible types of point measurements for upward migration of tritium and radon in the gas phase include a well-point modified with instrumentation capable of detecting these two radionuclides. In addition, future needs may include developing remediation technology such as a modified granulated activated carbon system similar to soil vapor extraction wells capable of capturing and treating gaseous radionuclides above ground.

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Long-term Stability of Contained Waste Forms (NV06-9801-11)

Methods are needed to control or accommodate the break-down of contained waste materials in arid desert environments and minimize the effects of subsidence. The break-down of radioactive materials in waste cells can result in subsidence. The technology would support the ongoing low-level waste disposal program at the Areas 3 and 5 Radioactive Waste Management Sites, including waste cell closure. The Nevada Test Site has ongoing low-level waste disposal responsibility. The requirement is to be able to predict material break-down. The capability is needed to identify the breakdown rates of contained materials in order to minimize subsidence or its effects.

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Enhanced Subsidence Through Induced or Deterred Corrosion/Decomposition of Waste Containers (NV07-9801-12)

A need to control subsidence through a decomposition/corrosion of waste containers, by either deterring or inducing decomposition or corrosion. The Nevada Test Site has been and will continue to be a site for radiological waste disposal. Disposal sites will be filled and capped on an as-needed basis. The extreme weather conditions at the Nevada Test Site and other arid sites limit the use of traditional landfill closure covers. The technology would support the draft 2006 Plan, the planned closure of disposal unit U3ax/bl in Area 3, and retired pits and trenches in Area 5. There will be long term disposal of low-level waste at the Nevada Test Site. Closure covers will be required for waste cells as they become full. The technology would be applicable to other arid site landfill closures, both DOE and non-DOE. Control subsidence through specific landfill container breakdown, both induced and deterred.

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